Radar Observations of the 9 March 2011 U.S. Central Gulf Coast Distinctive Bow Echo and Attendant Tornado-Producing Mesovortices

Jeffrey Medlin

Science and Operations Officer

NWS Forecast Office

Mobile, Alabama

* **Corresponding Author Contact Information**:

Jeffrey Medlin

4000 Lakefront Dr. W.

Mobile, AL 36695

jeff.medlin@noaa.gov

During the morning hours of 9 March 2011, a distinctive bow echo developed over southeastern Louisiana and later moved across the immediate north central Gulf Coast Region before dramatically weakening over the northwest Florida Panhandle. During its approximate five hour existence, the feature was associated with eight tornadoes and numerous damaging severe wind gusts ($\geq$25.7 ms^{-1}). The bow echo developed very shortly after a rear-flank downdraft associated with a high-precipitation supercell provided an initial impetus. Distinct line end counter-rotating vortices quickly developed and the northernmost member was associated with the majority (five) and strongest event tornadoes (EF2). The remaining three tornadoes were weaker and occurred along the bow's apex. During the course of the evolution, two notable descending rear-inflow jets were observed. The first was associated with the majority of the event's straight-line wind damage reports that occurred on the bow's apex along the Mississippi coastline while the second was associated with the most intense tornado in Baldwin County, AL (just east of Mobile Bay). The pre-storm environment was characterized by relatively high 0-6 km vertical wind shear (>25 m s^{-1}) and low thermodynamic instability (mixed-layer convective available potential energy between ~400-1100 J kg^{-1}). WSR-88D Velocity Azimuth Display winds were used to construct hodographs to capture vertical wind shear characteristics very near where the first two tornadoes occurred. Exceedingly high 0-1 km storm-relative helicity values (>1000 m^2 s^{-2}) were present along and ahead of the bowing structure and the nature of the tornado parent circulations were short-lived and confined to the lowest kilometer above ground. The bow echo formed very close to the Slidell, LA WSR-88D single-Doppler radar and later moved very close to that of Mobile, AL which provided for very thorough radar sampling conditions in the lower troposphere. This research focuses on the evolution of the northernmost cyclonically rotating bookend vortex, associated bow echo and the production of tornadoes. Particular attention is paid to the evolution and characteristics of the individual tornado-producing mesovortices that rapidly formed in close association with the northern bookend vortex.